

INSIGHTS INTO AVICENNA'S KNOWLEDGE OF GASTROINTESTINAL MEDICINE AND HIS ACCOUNT OF AN ENEMA DEVICE

POGLED NA AVICENINO ZNANJE O GASTROENTEROLOGIJI I NJEGOV DOPRINOS KORISNOSTI KLIZME

Golnoush Sadat Mahmoudi Nezhad^{1,2}, Behnam Dalfardi^{1,2},
Ahmad Ghanizadeh^{3,4}, Samad E. J. Golzari⁵

SUMMARY

Avicenna (980-1037 AD), also known as Sheikh or-Raeis, was an Muslim philosopher, physician, surgeon, astronomer, politician, encyclopedist, and mathematician. Avicenna's writings comprise of five books, know as the Al-Qanun fi al-Tibb (The Canon of Medicine) and the canon covers a wide variety of medical issues. This canon of medicine was the main reference for medical education in Western countries up until the 16th century and in the Middle East until the 19th century. Several chapters of the 3rd book of the Canon are devoted to a detailed description of gastrointestinal diseases including bowel obstruction, hemorrhoids anal fissures, perianal fistulas and perianal itching. Additionally, that same volume contains an illustration of an enema device. The aim of this paper was to present a brief

¹ Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran.

² Research Office for the History of Persian Medicine, Shiraz University of Medical Sciences, Shiraz, Iran.

³ Research Center for Psychiatry and Behavioral Sciences, Shiraz University of Medical Sciences, Hafez Hospital, Shiraz, Iran.

⁴ Department of Psychiatry, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran.

⁵ Department of Anesthesiology, Tabriz University of Medical Sciences, Tabriz, Iran.

Correspondence: Golnoush Sadat Mahmoudi Nezhad, Medical Student; Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran; Tel.: +98-916-6182554; Fax: +98-711-2302062; Electronic address: Golnooshm.Mahmoodi@gmail.com

review of Avicenna's 11th century views on bowel obstruction and to present his description of an enema device that has remained relatively unnoticed until now. Finally, this article illustrates similarities between Avicenna's explanation and modern medical science that celebrate Avicenna as an important contributor to medieval knowledge on gastrointestinal diseases, the science of which has been passed on to later generations.

Key words: Avicenna; Canon Medicinae; Gastrointestinal Diseases

INTRODUCTION

Today, gastrointestinal conditions such as bowel obstruction and related diseases, diagnostic and management methods have an important place in modern medicine. Such conditions are particularly important as they can cause the onset of a medical emergency [1-3].

It is widely accepted that modern scientific achievements in the field of gastroenterology are clearly indebted to past studies in the field. This research was done to determine important indicators of these diseases and related contrivances in medical texts surviving from past centuries, to display the critical considerations of these diseases in that era. This review has revealed that the main concern in The Canon of Medicine written by Avicenna (980-1037 AD) was that of gastrointestinal diseases and methods of managing such diseases.

Several gastrointestinal topics are discussed in detail in Avicenna's medical encyclopedia, Al-Qanun fi al-Tibb (The Canon of Medicine). Avicenna was the first to use reflected light to examine body cavities. This idea is now regarded as a key milestone in the history of endoscopy. Furthermore, Avicenna was the first in the history of medicine to describe gastric cancer and, there are other noteworthy issues in his text that have remained unnoticed. Among these are small and large bowel obstructions, hemorrhoids, anal fissures, perianal fistulas and perianal itching [4-7].

The aim of this paper was first to review Avicenna's 11th century viewpoints on diagnosis and management of bowel obstruction and then to discuss one of his important related innovations, the enema device, which until now has remained largely neglected.

AVICENNA AND THE CANON OF MEDICINE

Abu Ali Husain ibn-e Abdullah Ibn-e-Sina or Ibn-e-Sina in brief (Latin: Avicenna) (980–1037 AD), with the nickname of Sheikh or-Raeis, was an 11th century Muslim philosopher, physician, surgeon, astronomer, politician, encyclopedist, and mathematician (Figure 1) [8-10]. He originated from the village of Afshaneh near the town of Bukhara in the Old Persian Empire (now located in Uzbekistan), he was born in 980 AD (11).



Figure 1 - The Portrait of Avicenna on a Tajikistan banknote (1999).

Avicenna's life coincided with the Islamic Golden Age of Medicine (9th to 12th century AD) [12]. Due to his several remarkable and original contributions to medical science, the writings of Avicenna have remained pertinent to subsequent scholars. Today, he is recognized as the second most important teacher after Aristotle with titles such as; Aristotle of Arabians, Chief and Prince of Physicians and an Islamic Galen [11,13].

Avicenna is the author of a five-volume textbook, known as *Al-Qanun fi al-Tibb* (The Canon of Medicine) (Figure 2). This text has been an important source of medical education in Western countries up to the 16th century and in the Middle East until the 19th century [11,15]. The writing of this book was completed on 1025 AD [12]. Due to its specific qualities and significant influence on medicine, the Canon is known as The Medical Bible of the Middle East [16]. It could be claimed that The Canon of Medicine is the most influential medical encyclopedia ever written [13].

No one can deny Avicenna's great contribution to medicine. He is one of the greatest scientists in the history of medicine and his ideas that were novel at the time, have made an important contribution to the progression



Figure 2 - Opening in the middle of the third book of Canon (probably, belonging to the beginning of 17th century). This page is discussing the anatomy of stomach and intestines. (Courtesy US National Library of Medicine)

of medical science. Avicenna's work has currently attracted the attention of many physicians and researchers, not only with precise descriptions of different diseases, but management and treatment strategies described in the canon are also well regarded [17-20].

AVICENNA'S DISCOURSE ON BOWEL OBSTRUCTION

Based on his knowledge of human anatomy, Avicenna distinguished between small and large bowel obstructions (called *ilaws* and *al-qulanj*, respectively). As briefly reviewed here, he presented a detailed description of the different aspects of intestinal obstruction and approaches to its management [6].

ETIOLOGY

Avicenna categorized the causes of bowel obstruction as two main types: etiologies from the bowel itself (corresponding to intraluminal and intramural factors in current terminology) and those originating from other organs in the vicinity of the intestine (matching the extrinsic etiologies in today's nomenclature). As examples of the first group, he introduced heavy worm infection, loss of activity of the colon wall muscles, '*al-varam*' (inflammation) of the intestinal wall, torsion of the bowel loops, intestinal loop herniation (*al-fatgh*), fecal impaction, and delay in defecation as the causes of bowel obstruction. In describing the second group, Avicenna presented conditions such as renal colic to the etiology of bowel obstruction (that correspond to the paralytic ileus in today's nomenclature). Avicenna's mentioned etiologies of intestinal obstruction are concordant with modern known causes of this disease [6,21-24]. He explained:

"'Qulanj' is one of the intestinal diseases that produces pain and that prevents the stool from passing in its natural way. 'Qulanj' causes disease in the large intestine called 'Qulon'...if this happens in the small intestine it is called 'ilaeus'. Sometimes the pain and effect of 'Qulanj' is similar to that of 'ilaws', and sometimes 'ilaws' is confused with 'Qulanj'. The causes of 'Qulanj' are as follows: 1 - caused by the large qulon (intestine).2. - caused in the 'Qulon' and is transferred to the intestine..." he continued: "maybe the 'varam' [inflammation] appears in the liver or bladder or kidney or spleen and that the 'varam' affects the intestine...or kidney to feel pain due to a stone and the intestine partake from the kidney pain and become disable ...the pain from kidney stone is similar to the pain of 'Qulanj'..." [6].

In Avicenna's opinion, some additional factors such as dehydration, opium abuse, and consumption of certain food can predispose a patient to disturbed stool passage, constipation and consequently bowel obstruction. Today, the constipating effect from the aforementioned factors has been proven [6,25,26].

SEMIOLOGY

He described Avicenna's statements as follows:

"the patient wants to defecate many times but he is unable to defecate, decreasing or loss of appetite ...feels nausea and vomiting, especially during eating greasy or sweet food...feels abdominal pain repeatedly, feels severe thirst, the presence of a sense of defecation without the ability to defecate (early in the disease course), feels pain in the back and legs...after lasting time the manifestation become more severe and abdomen reach in a stage that [patient] cannot defecate or pass gass,..."

Considering Avicenna's statements, he explained the following manifestations: anorexia, nausea, vomiting (especially after eating), abdominal distention, severe, progressive and intermittent abdominal pain, back and leg pain, and obstipation as the clinical manifestations of bowel obstruction. As he explained, some findings including palpitations, cold extremities, cold sweating, change in consciousness and confusion are probably indicative of a severe stage of bowel obstruction. Moreover, he considered some specific manifestations of small intestine obstruction such as, epigastric pain, an increased possibility of fecal vomiting, bad breath and foul belching [6].

It is noteworthy that Avicenna provided early knowledge of the differentiation between small and large bowel obstructions long before efforts of the 18th century [6,25].

PROGNOSIS

Avicenna described low frequency of episodes of abdominal pain, a good response to enema, gas passing, and passage of fecal material as good prognostic characteristics of bowel obstruction. In contrast to previous features, he explained: 'severe abdominal pain, constant nausea and vomiting, cold sweating, cold extremities due to sever pain are bad sign ...', then he also identified hiccupping, and abnormal respiration as poor prognostic manifestations of an intestinal obstruction. Avicenna mentioned that bowel obstruction can be life threatening [6].

DIFFERENTIAL DIAGNOSIS

Similar to present day knowledge of this issue, Avicenna introduced renal colicky pain as a differential diagnosis to pain resulting from bowel obstruction. In order to distinguish between these two conditions Avicenna relied on the following features; *"characteristics of the pain, comparing the characteristics of both diseases and concluding from it,.. the severity of manifestations*

of disease” then he expand his explanation of the pain (including its severity, location, timing, shifting, and radiation), factors which aggravate or relieve the pain in each condition (such as pain relief by defecation in obstruction of intestine), and types and qualities of the body’s waste materials (i.e. stool or urine) [6,27].

MANAGEMENT

With reference to management of bowel obstruction, Avicenna recommended cessation of oral feeding (NPO status in modern medicine) as the first step. In his opinion minor vomiting is helpful to a patient with the condition of bowel obstruction but that severe vomiting could be life threatening. Avicenna’s doctrine prohibits use of laxatives and forbids administration of opium for relieve from the pain of intestinal obstruction. In Avicenna’s opinion, the use of opium can mask a patient’s pain and that could contribute to progression of the disease to a more severe stage, such as bowel perforation. He also suggested sitting in a warm water bath for pain relief from such conditions. He prescribed several remedies that he believed could be helpful in the treatment of bowel obstruction [6].

In addition to pharmacological treatments, Avicenna strongly recommended application of an enema (al-Hoghanah) as a beneficial for patients with bowel obstruction. Included in his work is an illustration of a device to carry out a successful enema. In addition to the structure of this enema device, he indicated the necessity of a squeezable bag attached to the device for drug delivery, the description is as follows:

“The tube lumen should be divided into two parts with a proportion of $\frac{1}{3}$ - $\frac{2}{3}$. A membrane should be placed between these two segments. ... a bag should be connected to the proximal opening of the larger channel and its distal part should remain open. ... the distal opening of the smaller channel [at the tip of the instrument] should remain open. ... the proximal opening of the smaller channel should be closed to prevent air from entering into the rectum. There should be a small fenestration in the proximal end of the instrument [in the smaller channel wall] to allow gas passage from the bowel to outside the human body. This gas passage will be helpful to the stimulation of defecation....”.

Avicenna recommended that the squeezable bag be used to push liquid drugs into the rectum. He explained that an enema is less useful in for treating small bowel obstruction [6]. Remarkably, although enema application has a long history, for what may be the first time in the history of medicine,



Figure 3 - A Persian illustration showing the 18th century use of enema device.

Avicenna expounded a squeezable portion to the device (Figure 3) [28].

Avicenna has also given details of proposed positioning of patients before enema application. A number of positions are described that he thought would be suitable (Figure 4). For example, in one of his illustrated positions, the patient should lie on his left side, stretch his body in the lower left extremity and bend the right lower extremity to the chest (corresponding to the lateral decubitus position in current terminology). In order to facilitate entry of the enema device into the rectum, Avicenna also recommended topical application of lubricating agents to the anus and the tip of the enema device [6].

Lying on the left side with the left leg straight and the right leg bent at the knee. (Sims' position)*



Leaning on the knee, hand and chest. (Knee-Chest position)*



Lying on the back with knees bent position. (Position for self administration)*



* Today's nomenclature

Figure 4 - A schematic figure showing the Avicenna's described enema positions.

DISCUSSION

In today's management of bowel obstruction, especially small bowel obstruction and means of diagnosis according to history and physical examination and its management is still challenging for clinicians [29]. Acute small bowel obstruction is estimated as a common cause of emergency hospital admission, it has morbidity rate of 30% from occurrence of strangulation. Today most cases of obstruction are due to adhesion mainly after an operation [30]. The present day Science is indebted to the works of figures in the past. Scholars lived in Persia, including Avicenna, had a major role in promoting science, especially gastrointestinal medicine.[31-34] Considering Avicenna's statement, it seems that for centuries scientists have paid attention to intestinal obstructions as a critical disease and knew its characteristics, differential diagnosis and its management. Avicenna was one of the first to explain this subject in his Canon. Although, enema application is an old medical procedure that originates from times before Avicenna, and use of the enema device was common among people in places such as Greece, Rome, Egypt, and China [35,36]. Avicenna's description of the enema is detailed and its use constitutes a substantial part of his Canon of medicine.

CONCLUSION

The medieval Muslim scientist Avicenna provided a meticulous description for classification of etiologies, ways to diagnosis and deal with some gastrointestinal diseases that serve as evidence of his knowledge of this particular branch of medicine. The explanations of Avicenna demonstrate several similarities to modern medical scientific doctrine. For what seems to be the first time in the history of medicine, Avicenna introduced the squeezable portion of the enema device. It can be said that Avicenna was an important contributor to medieval knowledge on gastrointestinal diseases and the transfer of this science to later generations.

REFERENCES

1. Tkacz JN, Anderson SA, Soto J. MR imaging in gastrointestinal emergencies. *Radiographics* 2009;29:1767-80.
2. Shah S. An update on common gastrointestinal emergencies. *Emerg Med Clin North Am* 2013;31:775-93.
3. Myer PA, Mannalithara A, Singh G, Singh G, Pasricha PJ, Ladabaum U. Clinical and economic burden of emergency department visits due to gastrointestinal diseases in the United States. *Am J Gastroenterol* 2013;108:1496-507.
4. Nezhat C. Nezhat's history of endoscopy: A historical analysis of endoscopy's ascension since antiquity. Tuttlingen (Germany): Endo-Press; 2011. p9.
5. Santoro E. The history of gastric cancer: legends and chronicles. *Gastric Cancer* 2005;8:71-4.
6. Shrafkandi A. *Al-Qanun-fi-al-Tibb (The Canon of Medicine)* by Avicenna. Volume 3 (Part 3). Tehran (Iran): Soroush Press; 1991. pp6-55, 71-95. [in Persian]
7. Dalfardi B, Mahmoudi Nezhad GS. Insights into Avicenna's Contributions to the Science of Surgery. *World J Surg* 2014;38(8):2175-9. doi: 10.1007/s00268-014-2477-3.
8. Shoja MM, Tubbs RS. The history of anatomy in Persia. *J Anat* 2007;210:359-78.
9. Dalfardi B, Mahmoudi Nezhad GS, and Ghanizadeh A. Avicenna's description of cardiac tamponade. *Int J Cardiol* 2014;172(1):e145-6. doi: 10.1016/j.ijcard.2013.12.099.
10. Dalfardi, B, and Yarmohammadi H. The heart under the lens of Avicenna. *Int J Cardiol* 2014 Apr 15;173(1):e1-2. doi: 10.1016/j.ijcard.2014.02.030.
11. Shoja MM, Tubbs RS, Loukas M, Khalili M, Alakbarli F, Cohen-Gadol AA. Vasovagal syncope in the Canon of Avicenna: the first mention of carotid artery hypersensitivity. *Int J Cardiol* 2009;134:297-301.
12. Dalfardi B, MahmoudiNezhad GS, Mehdizadeh A. How did halyabbas look at the cardiovascular system?. *Int J Cardiol*. 2014 Mar 1;172(1):36-9 .
13. Namazi MR. Avicenna, 980-1037. *Am J Psychiatry* 2001;158:1796.
14. Aciduman A, Er U, Belen D. Peripheral nerve disorders and treatment strategies according to Avicenna in his medical treatise, Canon of medicine. *Neurosurgery* 2009;64:172-7.
15. Nejabat M, Maleki B, Nimrouzi M, Mahbodi A, Salehi A. Avicenna and cataracts: a new analysis of contributions to diagnosis and treatment from the Canon. *Iran Red Crescent Med J* 2012;14:265-70.
16. Prevezas N. Evolution of pelvic and acetabular surgery from ancient to modern times. *Injury* 2007;38:397-409.
17. Tashani OA, Johnson MI. Avicenna's concept of pain. *Libyan J Med* 2010;5.

18. Afshar A. A brief report about the concepts of hand disorders in the Canon of Medicine of Avicenna. *J Hand Surg Am* 2011;36:1509-14.
19. Modanlou HD. Avicenna (AD 980 to 1037) and the care of the newborn infant and breastfeeding. *J Perinatol* 2008;28:3-6.
20. Shoja MM, Rashidi MR, Tubbs RS, Etemadi J, Abbasnejad F, Agutter PS. Legacy of Avicenna and evidence-based medicine. *Int J Cardiol* 2011;150:243-6.
21. Hayakawa K, Tanikake M, Yoshida S, Urata Y, Inada Y, Narumi Y, et al. Radiological diagnosis of large-bowel obstruction: nonneoplastic etiology. *Jpn J Radiol* 2012;30:541-52.
22. Malik AM, Shah M, Pathan R, Sufi K. Pattern of acute intestinal obstruction: Is There a change in the underlying etiology?. *Saudi J Gastroenterol* 2010;16:272-4
23. Dayton MT, Dempsey DT, Larson GM, Posner AR. New paradigms in the treatment of small bowel obstruction. *Curr Prob ISurg* 2012;49:642-717.
24. Hayden GE, Sprouse KL. Bowel obstruction and hernia. *Emerg Med Clin North Am* 2011;29:319-45.
25. Benyamin R, Trescot AM, Datta S, Buenaventura R, Adlaka R, Sehgal N, et al. Opioid complications and side effects. *Pain Physician* 2008;11:S105-20.
26. Arnaud MJ. Mild dehydration: a risk factor of constipation? *Eur J Clin Nutr* 2003;57:S88-95.
27. Rippel C, Raman JD. Acute flank pain. In: Knoll T, Pearle MS, editors. *Clinical management of urolithiasis*. Berlin-Heidelberg: Springer; 2013. pp19-27.
28. Kravetz RE. The enema. *Am J Gastroenterol* 2001;96:2486.
29. Zielinski MD, Eiken PW, Bannon MP, Heller SF, Lohse CM, Huebner M ,et al. *World J Surg* 2010;34(5):910-9. doi: 10.1007/s00268-010-0479-3. .
30. Tieris I, Mavrantonis C, Stratoulis C, Panousis G, Mpetsou A, Kalochristianakis N. . Laparoscopy for acute small bowel obstruction: indication or contraindication? *Surg Endosc*. 2011 Feb;25(2):531-5. doi: 10.1007/s00464-010-1206-8.
31. Mahmoudi Nezhad GS, Dalfardi B. Rhazes (865-925AD), the icon of Persian cardiology. *Int J Cardiol*. 2014;177(3):744-7. doi: 10.1016/j.ijcard.2014.11.045
32. Kardeh S, Choopani R, Mahmoudi Nezhad GS, Zargarani A. The Urinary Catheter and Its Significant Applications Described by Avicenna (980-1037 AD) in the Canon of Medicine. *Urology*. 2014 Nov;84(5):993-6
33. Dalfardi B, Mahmoudi Nezhad GS, Ghanizadeh A. Rhazes' description of a case with aortic regurgitation. *Int J Cardiol*. 2014;172(1):e147-8
34. Dalfardi B, Mahmoudi Nezhad GS, Ghanizadeh A. Al-Akhawayni's account of carotid sinus hypersensitivity. *Int J Cardiol* 2014;172(1):e143-4, doi: 10.1016/j.ijcard.2013.12.105.

35. Bellamy I, MacLean D. Radiant Healing: The Many Paths to Personal Harmony and Planetary Wholeness. Joshua Books: 2005; p. 232-9.
36. Magner LN. A History of Medicine. CRC Press: 1992; p. 26.

SAŽETAK

Avicenna (980.–1037.), poznat i kao Sheikh or-Raeis, bio je islamski filozof, liječnik, kirurg, astronom, političar, enciklopedist i matematičar. Dao je značajan i poseban doprinos kako islamskoj tako i zapadnjačkoj medicini, a koji je trajao stojećima nakon njegove smrti. Avicennina pisana djela sastoje se od pet knjiga, poznata kao Al-Qanun fi al-Tibb (Kanon medicine), koji pokriva široko područje medicinske problematike. Kanon medicine bio je glavna referencija u medicinskoj edukaciji u zapadnjačkim zemljama do 16. stoljeća, a u zemljama Srednjeg istoka do 19. stoljeća. Nekoliko poglavlja treće knjige Kanona posvećeno je detaljnu opisu gastrointestinalnih bolesti, uključujući opstrukciju crijeva, hemoroide, analne fisure, perianalne fistule i perianalni svrbež. Osim toga isti volumen sadrži ilustraciju klizme. Cilj ovog rada bio je ukratko prikazati Avicennino viđenje opstrukcije crijeva koji datira u 11. stoljeće i predstaviti njegov dosad relativno nepoznat opis klizme. Konačno, ovaj članak ilustrira sličnosti između Avicennina objašnjenja te onog suvremene medicinske znanosti, koja štuje Avicenu, značajnog prinositelja poznavanju gastrointestinalnih bolesti u srednjem vijeku, znanja koja je preneseno kasnijim generacijama.

Ključne riječi: Avicena; Kanon; gastrointestinalne bolesti